

# Boiler troubles



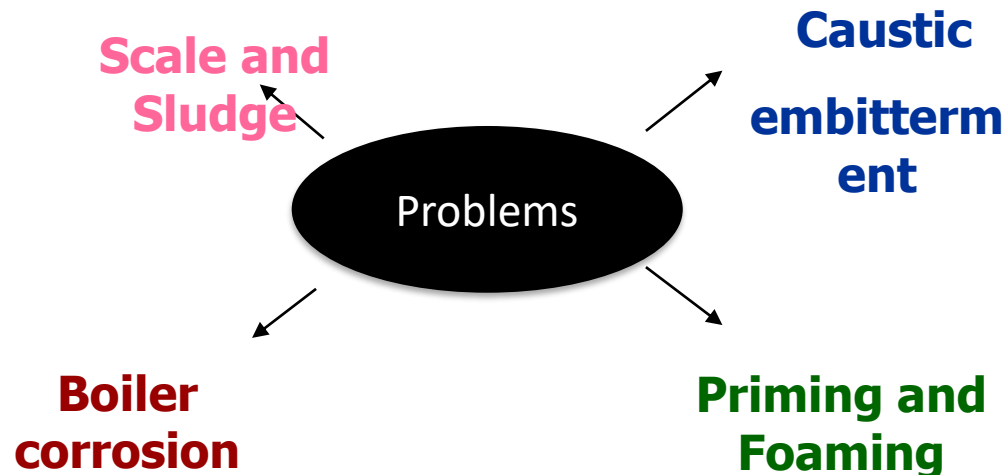
# Boiler Feed Water

“The water mainly used in boilers for steam generation is known as boiler feed water”.

For such water we need some specification:

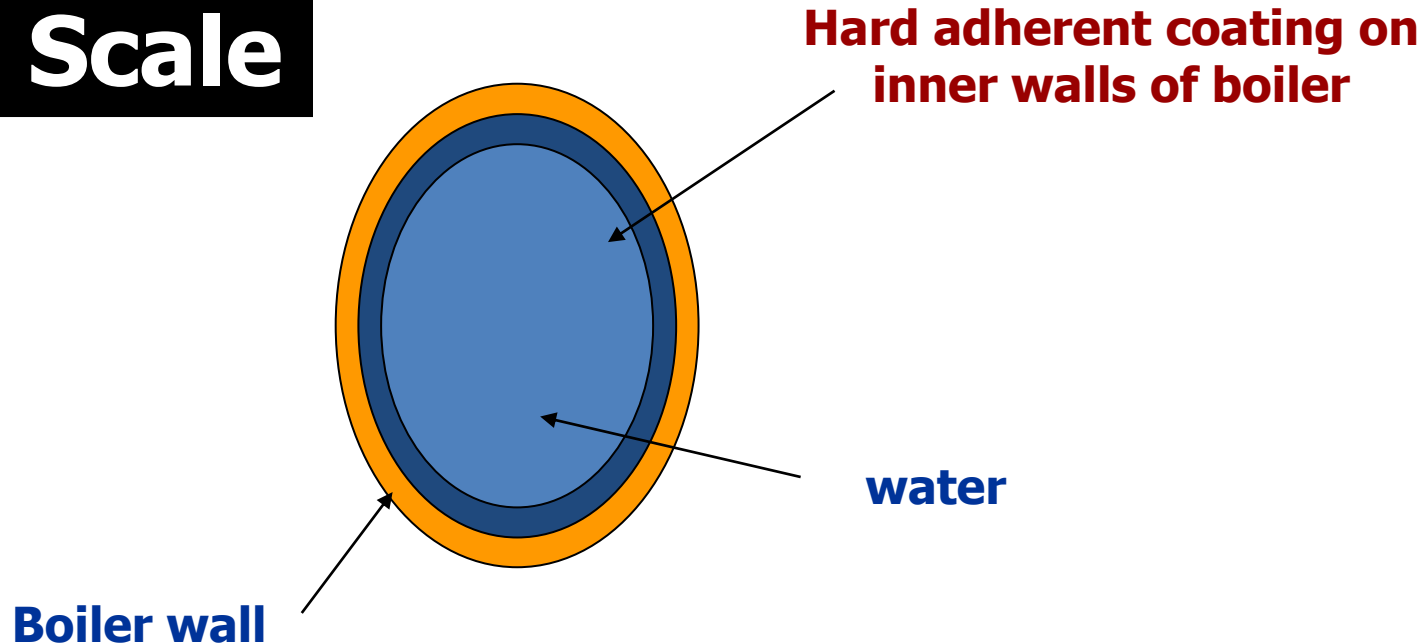
- **Hardness should be below 0.2 ppm**
- **Its caustic alkalinity (due to  $\text{OH}^-$ ) should be in the range of 0.15 – 0.45 ppm.**
- **Its soda alkalinity (due to  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ) should be in the range of 0.45 – 1.0 ppm.**

Excess of above impurities cause the following problems-



# Boiler problems

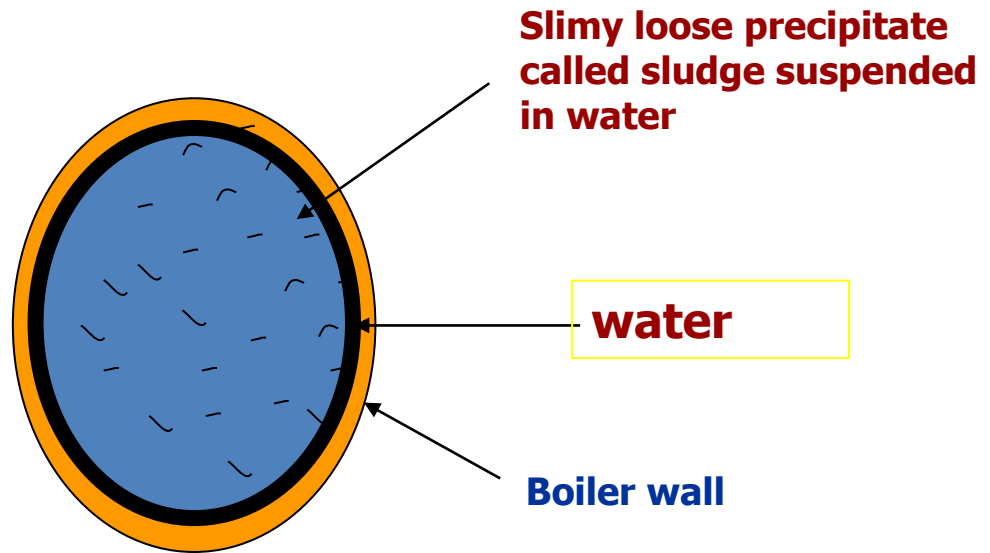
## 1. Scale



- Scales are hard deposits firmly sticking to the inner surface of the boiler. Scale may be formed inside the boiler due to decomposition of calcium-bicarbonate  $[Ca(HCO_3)_2]$ .

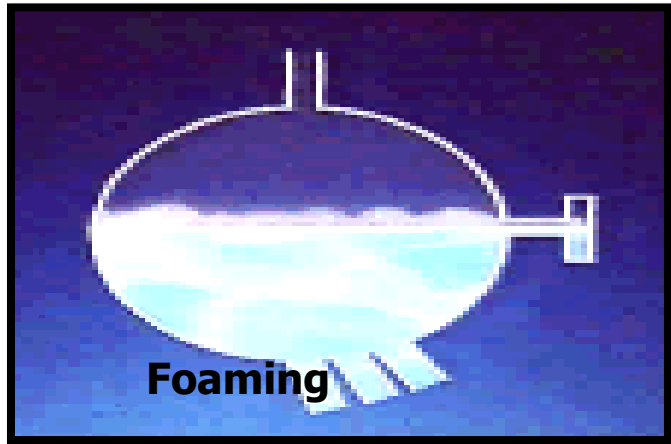


# 1. Sludge

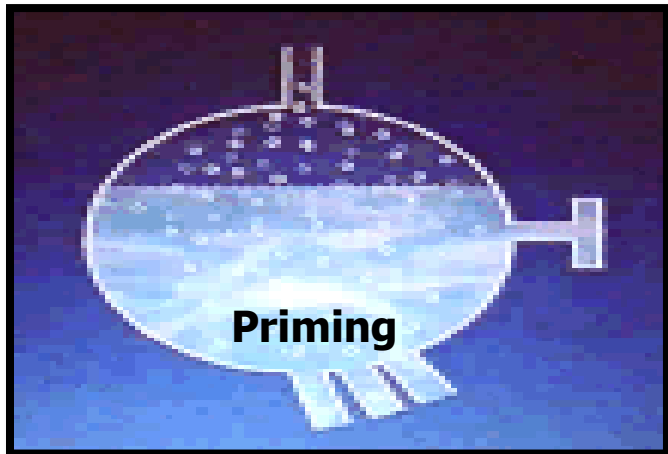


Sludge is a soft, loose and slimy precipitate formed within the boiler. It can be easily scrapped off with a wire brush.

## II. Priming and foaming



**Foaming-** It is the production of continuous foam or hard bubbles in boilers. Foaming is due to the presence of substance like oil in boiling water.



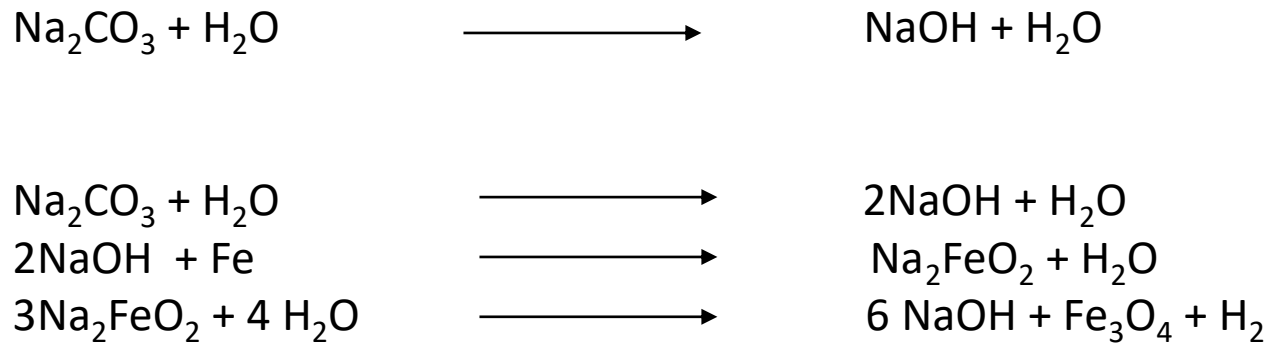
**Priming-** It is the process in which some particles in water are carried along with the steam. The resulting process is called as wet steam or carry over. The process of formation of wet steam in boilers is called as priming.

### **Causes of Priming,**

1. Presence of dissolved salts
2. High velocity steam due to sudden boiling
3. Improper boiler design

### III. Caustic embitterment

❖ **Boiler corrosion which takes place due to presence of highly alkaline water in boiler is known as caustic embrittlement**



### IV. Boiler corrosion

Degradation or destruction of boiler materials (Fe) due to the electrochemical attack is called boiler corrosion

# Prevention of scale formation

## Internal conditioning methods - of boiler water to prevent scale formation

1. **Colloidal conditioning – spreading of organic compounds like tannin, agar gel**
2. **Carbonate conditioning – addition of carbonate compound**
3. **Phosphate conditioning – addition of phosphate compound**
4. **Calgon conditioning – addition of sodium hexa meta phosphate**

### 1. Colloidal conditioning

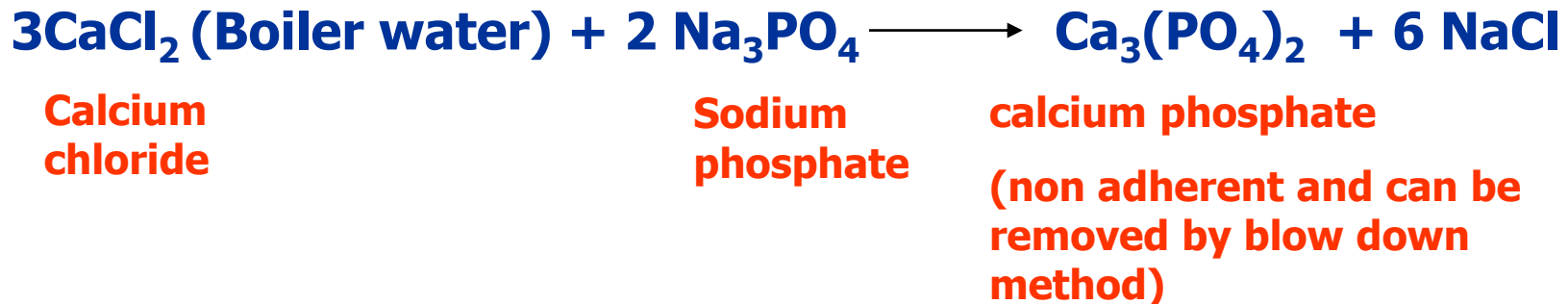
Scale formation can be avoided by adding **organic substances** like **kerosene, tannin, agar-agar** etc. These substances get coated over the scale forming precipitates, thereby yielding non-sticky and loose deposits similar to sludge which can be removed by blow down operation.

## 2. Carbonate conditioning



Caution: Excess  $\text{Na}_2\text{CO}_3$  can result in caustic embrittlement

## 3. Phosphate conditioning



Scale formation can be prevented by adding sodium phosphate to the boiler water which reacts with the hardness producing ions and forms easily removable phosphate salts of respective ions



## 4. Calgon conditioning

- Calgon conditioning is a most useful method to remove hardness products (i.e. scale & sludge) from boiler.
- In this process the **Graham's salt** is used. Graham's Salt is also known as **Calgon (sodium hexa metaphosphate)**.
- Calgon (**sodium hexa metaphosphate**) is soluble in water and it converts the impurity like  $\text{CaCO}_3$ ,  $\text{CaSO}_4$  into soluble complex compound, which will remain in dissolved form in water. This property helps to remove the scale and sludge.

## 4. Calgon conditioning continue....



sodium hexa meta phosphate



**Calcium Sulfate**

**Soluble complex ion of calcium -  
can be removed easily**

**Calgon tablets are used in the cleaning of washing machine  
drums**

# Quiz



- What is boiler feed water?
- What are the requirements for Boiler feed water?
- What is priming and foaming?
- Boiler corrosion due to use of highly alkaline water is called\_\_\_\_\_
- What is scale and sludge?

# FAQ



- **What do you mean by boiler feed water? Explain the calgon conditioning method of descaling?**
- **Define the following terms:**
  - Priming and Foaming
  - Caustic embrittlement
  - Sludge and Scales.